U.S. Army Corps of Engineers

ISOLATION BARRIER ALIGNMENT ALTERNATIVES ASSESSMENT
Amendment 1

WEST LAKE LANDFILL BRIDGETON, MISSOURI

FOR

Environmental Protection Agency Region 7
Superfund Program

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1. Introduction

In 2014, the U.S. Environmental Protection Agency (EPA) requested the United States Army Corps of Engineers (USACE) evaluate information conveyed by the Responsible Parties (RPs) during discussions between USACE, the RPs, EPA Superfund personnel (EPA), and EPA's Office of Research and Development (ORD) regarding proposed locations and alignments of an Isolation Barrier (IB) at West Lake Landfill in Bridgeton, Missouri. The purpose for constructing an IB is to prevent a subsurface smoldering event (SSE) in the adjacent Bridgeton Sanitary Landfill from coming into contact with radiologically impacted materials (RIM) located in Operable Unit 1 (OU1) Area 1 of the West Lake Landfill. In August, 2014, USACE submitted an Isolation Barrier Alignment Alternatives Assessment Report. The 2014 assessment focused on the proposed alignments, the feasibility of constructing the IB, the comparative advantages and disadvantages of the proposed alignments, and the associated risks.

One of the key findings from the report was that the extent of radiological material in the West Lake Landfill was not fully characterized which was necessary to be able to quantify risks associated with RIM remaining south of any barrier and inform EPA's decision on alignment. During spring and summer of 2015, the RPs performed additional investigations to determine the extent of RIM. In addition, over the last year, the RP's have been performing a thermal barrier pilot study in which liquid is circulated through converted Gas Interceptor Wells (GIW) south of the neck area (narrow section between south and north quarry landfills) to determine if this could remove sufficient heat from the waste to halt advancement of the SSE.

This 2015 assessment amends the 2014 assessment to take into consideration results of the additional RIM investigation and a more detailed evaluation of the RP's cooling barrier alternative. Because USACE has not been provided with detailed design drawings, calculations, or lab analyses from recent sampling events, this evaluation assumes the results of calculations and lab analysis presented are an accurate representation of the data. As additional information becomes available, this assessment may change.

Key points of the assessment are summarized below:

1. <u>Comparison of IB Alternatives</u>
To date, the information presented by the RPs regarding the design and construction of the IB is still at a conceptual stage. As such, this assessment is qualitative in nature and consists primarily of identifying the advantages and disadvantages of the proposed alternatives when compared to each other. The heat extraction barrier offers more advantages relative to the other alternatives; however, the advantages and disadvantages of each alternative carry risk and the extent of those risks and the ability to mitigate those risks must be carefully considered when selecting an alternative.

2. Duration of the IB Design and Construction Effort
According to the RPs, movement of the SSE currently present in the South Quarry appears to have slowed and is located in the southeastern portion of the South Quarry landfill, the furthest distance from the RIM seen to date. However, movement of the SSE has been difficult to predict so response time to design and construct a barrier are important considerations on deciding which barrier alternative offers the best chance of intercepting the SSE before it comes in contact with the RIM.

3. Legal Prohibition Against Exposing Landfill Waste Material
The Negative Easement Agreement (NEA) between the City of St. Louis/St. Louis Airport Authority and the RPs is a critical factor to be considered as part of the design and construction of the IB. The NEA prohibits any activity that will result in the landfill cover being compromised due to bird hazard risk to aircraft posed by exposed waste. Fifteen to 20 million passengers fly into Lambert each year, therefore, minimizing bird hazard risk is a key consideration in selecting a barrier alternative. A waiver to the NEA will be required to install the IB, no matter what alternative is selected. Communication with the City of St. Louis and St. Louis Airport Authority to determine which IB alternative would be able to obtain a NEA waiver is vital in selecting the final alternative.

2. Background

West Lake Landfill accepted RIM in 1973 when leached barium sulfate residues from uranium ore processing was mixed with soil, transported to West Lake, and used as daily cover for landfill operations. RIM is present in areas designated as OU1, Areas 1 and 2. Area 1 is located adjacent to the Bridgeton Sanitary Landfill, a former quarry that was converted to a landfill and operated under a Missouri Department of Natural Resources (MDNR) permit from 1979 until 2005. OU1 Area 2 is not physically connected to OU1 Area 1 or the Bridgeton Sanitary Landfill. The Bridgeton Sanitary Landfill, which consists of the North Quarry and the South Quarry areas, was closed in 2005 due to an expansion of the nearby Lambert Airport and the potential bird hazard the landfill operations could pose to air traffic. In 2010, elevated temperatures were identified in the South Quarry area of the Bridgeton Sanitary Landfill, indicating a possible SSE. The SSE was confirmed in 2012 through significant subsidence in a portion of the landfill surface. In May 2013, in response to an Order of Preliminary Injunction filed by the Missouri Attorney General and MDNR, the RPs prepared a North Quarry Contingency Plan which set temperature, settlement front movement, and carbon monoxide emission thresholds that, if exceeded, would trigger the RPs' response, which included installing an IB between the RIM in OU1 Area 1 and the SSE. Per subsequent agreements, the RPs are pursuing installation of the IB.

3. RIM Isolation Alternatives

During June and July 2014, technical discussions involving USACE, EPA, ORD, and the RPs were conducted regarding potential RIM isolation alternatives. The two primary alternatives discussed consisted of: 1) construction of a concrete isolation barrier wall to prevent the SSE from progressing into the West Lake Landfill, or 2) excavation of waste to create an air gap that would interrupt the "waste to waste connection" between the Bridgeton Sanitary Landfill and the West Lake Landfill OU1 Area 1. Each of these alternatives is discussed below. Implementation of a heat extraction barrier was also discussed in 2014; however no data was submitted to demonstrate this would be an effective alternative, therefore no further evaluation was performed. Due to lack of data to support potential effectiveness of a heat extraction barrier, it was not further considered at that time.

Heat Extraction Update

During 2013, the RPs performed a heat removal pilot study that consisted of converting a single Gas Interceptor Well 4 (GIW-4) south of the neck area, to a closed loop water circulating well. Water was circulated down the well with a small diameter inner pipe and back up the well in a larger diameter outer pipe. As the water circulated it absorbed heat from the waste mass resulting in higher exit temperatures in the water. This heat was removed from the exit water by cycling it through a cooling tower prior to recirculation through the well. After identifying favorable results, the system was expanded in 2014 and 2015 to a 13-well closed loop glycol circulating system. In October 2015, the RP's presented results of computer modeling based on data collected during the pilot study to EPA to demonstrate that a heat extraction barrier could be a viable alternative to prevent advancement of the SSE through the neck into the North Quarry Landfill. In November 2015, at the request of Missouri Department of Natural Resources (MDNR), the RPs submitted a preliminary design package for a heat extraction system along with the results of the pilot study. USACE reviewed this information. Based on the pilot study results and computer modeling the heat extraction barrier has been included as an Isolation Barrier alternative evaluated in this amendment.

3.1 *Concrete Isolation Barrier Wall*

During the USACE, EPA, ORD, and the RP's initial discussion of the concrete isolation barrier wall in 2014, three potential wall alignments were proposed by the RPs. The alignments are described below:

> Alignment 1 – The IB would be located in West Lake Landfill OU1 Area 1 starting from the eastern fence line and running in a west-southwest direction towards the current Transfer Station building, terminating east of the Transfer Station. In this alignment, the IB would not cross into the adjacent North Quarry landfill that overlies the southern portion of OU1 Area 1. The average depth of waste material along this alignment is estimated to be approximately 40 feet.
>
> Alignment 2 – The IB would be located far enough to the south of OU1 Area 1 to ensure that all RIM is located north of the IB. This would require the IB to be placed within the deepest part of the North Quarry landfill where the depth of waste material is reported to be 180 feet deep.
>
> Alignment 3 – The IB was initially to follow Alignment 1 along the eastern portion of the IB, then extend southward along an alignment that would attempt to have as much RIM as possible on the north side of the IB. In 2015, Figures identifying the extent of RIM from

the RP's recent investigation were made available to EPA and were reviewed by USACE. The figures identified RIM on the southern portion of the West Lake Landfill to within 20-feet from where the North Quarry landfill begins to transition to the deeper portions of the North Quarry. Based on the extent of RIM, USACE considered an additional Alignment 3 that would place the barrier such that all identified RIM is north of the IB. This additional Alignment 3 would be located along a similar alignment as the Option 3 alignment evaluated in the RP's October 2014 report titled, "Isolation Barrier Alternatives Analysis, West Lake Superfund Site". However, the western third of the wall would need to be shifted approximately 50-feet to the south to maintain all RIM north of the wall. The Option 3 Alignment in the October 2014 report stepped back from the North Quarry high wall at a 45 degree angle to minimize forces on the wall caused by settlement of the deeper North Quarry waste. Moving the wall closer to the deeper North Quarry waste would potentially cause some increase to these settlement forces but it is likely this could be accounted for in the structural design of the wall. The southern portion of the additional Alignment 3 would be located as close as 20-feet west of the North Quarry high wall and extend northeast along the North Quarry high wall for a distance of approximately 300-feet and then extend in a north/northeast direction maintaining an alignment as far away from the North Quarry high wall as possible but south of the RIM waste. The average depth to bedrock along the east end of the additional Alignment 3 is expected to be approximately 40 feet and the depth to bedrock along the west end of the additional Alignment 3 is expected to be approximately 70-feet after excavation to create the working platform for installation of the wall, similar to the Option 3 Alignment in the October 2014 report. This would add time to not only the design phase, but the construction phase as well. All other negative aspects of excavating an IB in a landfill would be increased including volume of excavated waste, bird hazard risks, odor, and worker risk.

All three proposed alignments are conceptual and the RPs have not performed any detailed design calculations or produced any plans or specifications. Therefore, estimated waste depth and corresponding waste volumes requiring excavation used in this analysis are qualitative and for the purpose of alignment comparison only.

3.2 *Excavation to Create an Air Gap*

Another alternative considered to isolate the RIM from the SSE consists of excavating all waste at the southern edge of the West Lake Landfill down to bedrock and creating an air gap that interrupts the waste to waste connection between the Bridgeton Sanitary Landfill and the West Lake Landfill and prevents the SSE from moving beyond the gap. The alignment of the air gap excavation would be the same as Alignment 1. As with the Alignment 1 concrete barrier wall, the depth of the excavation along that alignment would average approximately 40 feet. For slope stability purposes, it was estimated that the excavation would need to be sloped at a ratio of between 2.5 to 3.0 horizontal to 1 vertical. The RPs estimated the volume of waste material excavated for this alternative, including bulking, was approximately 500,000-600,000 cubic yards. However, based on the recent Phase 1D investigation and the discovery of RIM further south, the alignment of this excavation would need to be shifted further south. Although updated volume calculations have not been performed, the volume of excavation required would be substantially higher that the estimated 500,000-600,000 cubic yards needed to create an air gap along Alignment 1.

While the air gap alternative would require no physical structure to be constructed, it was determined that it offered no other significant advantages over a concrete isolation barrier wall. It was also determined that the excessive waste excavation and handling would cause significant concerns with bird hazards, odor, on site waste management, and off-site waste transport. The large volume and the need to excavate through RIM would increase the safety risk to on-site workers and to off-site receptors. Additionally, because the air gap would essentially create a large depression in the ground, accumulated storm water runoff for such a feature would be complex and difficult to manage. Based on the significant disadvantages of this alternative, all parties agreed that this option would not be retained for further consideration at this time.

3.3 *Heat Extraction Barrier*

In November, 2015, the RPs provided a report, "Technical Evaluation of a Heat Extraction Barrier, Bridgeton Landfill, Bridgeton, St. Louis County, Missouri". This report was provided in response to the Missouri Department of Natural Resources' (MDNR's) request that the RPs provide a work plan and schedule identifying a technology that may be used to halt any potential movement of the South Quarry smoldering reaction.

The RPs used information obtained from the heat extraction pilot study of 13 cooling wells and 11 temperature monitoring probe (TMPs) to estimate thermal properties of the waste to produce a heat extraction computer model. Results of the pilot study and modeling of a heat extraction barrier were included in a November 2015 report submitted by the RPs titled, "Technical Evaluation of a Heat Extraction Barrier, Bridgeton Landfill, Bridgeton, St. Louis County, Missouri".

Based upon USACE review, there was sufficient information provided in the RP's report to demonstrate that a heat extraction system is capable of cooling the surrounding waste material within 10 feet of the cooling wells. However, the pilot study report did not include any computer modeling to simulate an event where the actual temperatures were higher than the heating front temperature. A more detailed design would be necessary that included all calculations and assumptions in selecting input parameters to the model to determine if the proposed system as submitted to MDNR is sufficient to prevent the movement of an SSE through the neck. In addition, the design should include a monitoring program that verifies performance of the system and a program of system expansion should monitoring data show higher than expected temperatures progressing north toward the neck. However, for the purposes of this assessment, the RPs have demonstrated a heat extraction system is a viable alternative to a structural barrier wall in halting progress of an SSE heat front, given proper design of the system.

4. <u>IB Alternatives Assessment</u>

This section presents the factors used during the assessment, identifies the advantages and disadvantages of each alignment, and provides a relative comparison of each alignment's advantages and disadvantages with respect to each factor. Note that this evaluation was based on technical and logistical factors only and cost was not considered.

4.1 *Assessment Factors*

Advantages and disadvantages of each alternative were identified with respect to factors that directly or indirectly impact on-site workers, the surrounding community, the intended function of the alternative, and/or the time required to design and install the barrier. These factors are:

- Excavation Volume
- Odor Potential
- Bird Hazard Potential
- RIM Remaining South of the IB
- Potential for Future SSE North of IB
- On-Site Worker Safety
- Off-Site Public Safety
- Off-Site Waste Transportation and Disposal
- Duration of Design
- Duration of Construction
- Impact to Existing Infrastructure
- Technical Feasibility

During the assessment it was identified that the depth of the waste where the IB would be located drives the majority of the advantages and disadvantages. The deeper the waste, the larger the excavation volume, and the longer waste will remain exposed during the excavation process. The advantages and disadvantages of each alternative are listed below.

4.2 *IB Alternatives - Advantages and Disadvantages*

Structural IB Alignment 1 – Advantages

- Least volume of waste to excavate, stage, screen, transport, and dispose compared to other structural IB alignment alternatives
- Least odor potential to be emitted from the excavation due to shorter excavation time compared to other structural IB alignment alternatives
- Least bird hazard due to lowest volume of waste compared to other structural IB alignment alternatives
- Shortest design and construction duration due to smaller wall and shorter pre-design investigations compared to other structural IB alignment alternatives
- No impact to existing infrastructure on North Quarry

- Technically Feasible
- Least likely to have future SSE occur on north side of IB

Structural IB Alignment 1 – Disadvantages

- Highest RIM exposure potential for on-site workers due to IB being placed in area where RIM has been identified
- Higher off-site safety risk due to RIM excavation (dust generation)
- Higher risk due to off-site transportation of RIM and potential traffic accidents
- Leaves RIM on south side of IB where it could potentially be exposed to the SSE
- There are no known past applications of using a concrete wall as a heat barrier in a landfill
- Some studies have shown a degradation of concrete strength properties from prolonged exposure to high heat
- IB construction could disrupt transfer station operations and result in delayed or reduced trash service to impacted customers

Structural IB Alignment 2 – Advantages

- No RIM anticipated to be encountered during excavation
- All RIM anticipated to be located north of the IB structure
- Lowest off-site safety risk with respect to airborne RIM exposure

Structural IB Alignment 2 – Disadvantages

- Significantly more volume to be excavated than other alignment alternatives
- Highest odor potential due to longest duration for construction and volume of waste
- Highest risk of bird hazard potential due to the largest volume of waste and longest excavation time for all alignment alternatives
- Highest potential for a future SSE on the north side of the IB
- Highest on-site safety risk due to significantly high volumes of waste to be excavated and the uncertainty of contaminants other than RIM that may be encountered.
- Highest off-site general safety risk due to the significantly higher volume of waste that will require off-site disposal
- Longest design and construction time due to largest IB structure and largest volume of waste to be excavated
- There are no known past applications of using a concrete wall as a heat barrier in a landfill
- Some studies have shown a degradation of concrete strength properties from prolonged exposure to high heat
- Greatest impact to the North Quarry infrastructure that is used to balance landfill gas extraction and monitor for the SSE.
- At the limits of technical feasibility, potentially not feasible

Structural IB Alignment 3 – Advantages

- Little to no RIM is expected to be encountered during excavation compared to Alignment 1
- No RIM is anticipated to remain on the south side of the IB
- Less on-site safety risk than Alignment 1due to less RIM being encountered during excavation
- Less off-site safety risk anticipated due to less airborne RIM
- Less off-site disposal of RIM anticipated than Alignment 1
- Less impact to transfer station operations during construction is anticipated
- Technically feasible

Structural IB Alignment 3 – Disadvantages

- More volume of waste to excavate, stage, screen, transport, and dispose than Alignment 1. Will likely require multiple on-site staging areas
- Longer duration than Alignment 1 for odor to be emitted from the excavation due to larger volume of waste and longer excavation time
- Higher risk of bird hazard to air traffic than Alignment 1 due to larger volume of waste and longer excavation time
- Higher risk than Alignment 1 for a future SSE to occur north of the IB although risk is considered minimal
- There are no known past applications of using a concrete wall as a heat barrier in a landfill
- Some studies have shown a degradation of concrete strength properties from prolonged exposure to high heat
- Longer design and construction durations expected compared to Alignment 1 due to the location of the IB being closer to the North Quarry high wall and the need to design for larger differential settlement forces and slope stability concerns.
- North Quarry infrastructure used to balance landfill gas extraction and control/monitor for SSE will be impacted

Heat Extraction IB - Advantages

- Least volume of waste to excavate, stage, screen, transport, and dispose
- Least odor potential to be emitted from the excavation due to limited excavation for cooling line installation.
- Most flexible system to quickly expand should additional cooling points be required.
- Least bird hazard due to lowest volume of waste
- Lowest off-site safety risk due to limited excavation
- Lowest on-site worker risk due to limited excavation

- All RIM located on north side of thermal barrier
- Shortest design and construction duration
- No impact to existing infrastructure on North Quarry
- No disruption to transfer station operations
- Technically feasible

Heat Extraction IB – Disadvantages

- Least likely to isolate RIM if an SSE were to develop in the North Quarry; however a similar system could be installed south of the RIM much quicker than other barrier alternatives.
- Application of heat extraction wells for this purpose has had limited testing (the RP's pilot study).
- Wells will be subject to high heat, a corrosive environment, and waste settlement, all of which lead to shorter well life spans.

4.3 *Relative Comparison of Alignment Alternatives by Assessment Factor*

Table 1 shows the comparison of each alignment's advantages and disadvantages by assessment factor.

Table 1: Relative Comparison of Alternatives

Factor	Structural IB - Alignment 1	Structural IB - Alignment 2	Structural IB - Alignment 3	Heat Extraction IB
Excavation Volume	Least volume than other alignments~50,000 CY ±	Largest volume to be excavated due to excavation for working platform and 180-foot depth in North Quarry, and increased thickness of wall to resist increased loads	Approximately twice as much as Alignment 1 ~95,000 CY ±, significantly less than Alignment 2	Least amount of excavated volume of all alternatives. System requires wells and near surface coolant loop system.
Odor Potential	Least odor potential due to the lowest volume of waste handling	Highest odor potential than both Alignment 1 and 3 due to highest volume of waste handling. Would be similar to active landfill operations.	Higher odor potential than Alignment 1 due to higher volume of waste handling	Least odor potential of all options. Least amount of waste to be removed during well and cooling loop installation.
Bird Hazard Potential	Least bird hazard potential due to the lowest volume of waste handling	Highest bird hazard potential than both Alignment 1 and 3 due to highest volume of exposed waste. Would be similar to active landfill operations.	Higher bird hazard potential than Alignment 1 due to higher volume of waste handling	Minimal bird hazard potential due to limited waste handling
RIM Remaining South of Barrier	Most amount of RIM to remain south of IB compared to the other alignments	None –assumes that no RIM material was placed in the North Quarry landfill	Least amount of RIM would remain south of IB compared to Alignment 1 and potentially no RIM would remain	No RIM anticipated to be located south of the heat extraction IB location proposed by the RPs (in the Neck)
Potential for Future SSE North of Barrier	Anticipated to have the lowest potential for future SSE on the north side of IB due to waste being older and likely more fully degraded.	Anticipated to be the highest potential for a future SSE on the north side of the IB due to highest volume of newer, less degraded waste remaining north of the IB.	Anticipated to be higher potential than Alignment 1 for a future SSE on north side of the IB due to newer, less degraded waste remaining north of the IB but less than Alignment 2 due to less volume of newer waste remaining north of the IB	Anticipated to have the highest potential for a future SSE north of the IB. Can be offset by flexibility and ease of system expansion
On-Site Safety	Potentially greater on-site safety risk than Alternative 3 due to known RIM being excavated	Greatest on-site safety risk compared to Alignment 1 and 3 due to the significantly higher volume of waste excavated and handled. Lowest on-site safety risk due to RIM	Lower on-site safety risk than Alignment 1 if little or no RIM excavated but higher general safety risk than Alignment 1. Higher on-site safety risk than Alignment 2 if RIM is encountered	Lowest on-site safety risk due to no open excavation and no limited RIM exposure

Criteria	Alignment 1	Alignment 2	Alignment 3	Heat Extraction IB
Off-Site Safety	Potentially higher off-site safety risk than Alignment 3 during installation due to RIM excavation (dust generation) and off-site transportation of RIM (traffic accidents/spills).	Highest off-site safety risk due to the significantly higher volume of waste being excavated requiring off-site transportation, which increases truck traffic and risk for traffic accidents.	Lower off-site safety risk than Alignment 1 if no RIM (dust generation). Higher off-site safety risk than Alignment 1 due to off-site transportation (traffic accidents)	Lowest off-site safety risk due to limited dust from well installation and surface line excavation. Lowest risk for RIM exposure.
Off-Site Waste Transportation and Disposal	RIM waste excavated as part of wall installation will require off-site disposal.	Largest volume of off-site disposal of non-RIM waste will be required due to limited on-site waste disposal capacity	Off-site disposal potentially not required if all RIM is located north of alignment	No offsite waste transport anticipated.
Duration of Design	Shortest design duration due to shortest wall and shorter pre-design investigations	Longest design duration due to more than 180-foot depth requiring pre-design investigation and highly complex design	Longer design duration than Alignment 1 due to longer duration of pre-design investigations and more complex wall design due to increased depth	Shortest design duration due to well design completed. Requires surface equipment and coolant design preparation.
Duration of Construction	Shortest construction duration due to shortest wall	Longest construction duration than both Alignment 1 and 3 due to 180-foot depth, significantly wider wall to handle increase loading	Longer construction duration than Alignment 1 due to 30 to 40-foot increased depth of wall	Shortest duration of construction. No excavation, just well installation and cooling loop installation.
Impact to Existing Infrastructure	No impact to existing infrastructure on North Quarry but may impact operation of the transfer station, which could result in delayed or reduced trash service to impacted customers	Greatest impacts to the North Quarry Infrastructure used to balance landfill gas extraction and control/monitor the SSE	Moderate impacts to the North Quarry Infrastructure used to balance landfill gas extraction and control/monitor the SSE	No impact to existing infrastructure on North Quarry and no impact to operation of the transfer station.
Technical Feasibility	Technically Feasible - however there are no known past application of the use of concrete as a heat barrier in a landfill. Studies have shown degradation of concrete strength properties from prolonged exposure to high heat	At the limits of technical feasibility – potentially not feasible	Technically Feasible although more difficult than Alignment 1 - Feasible - however there are past application of the use of concrete as a heat barrier in a landfill. Studies have shown degradation of concrete strength properties from prolonged exposure to high heat	Technically feasible - Application of heat extraction wells for this purpose has had limited testing (the RP's pilot study)

4.4 *Structural IB Alignment 1 Advantages Discussion*

Of the three structural IB alignments, Alignment 1 is considered the most technically feasible and will require the least volume of waste to be excavated. The RPs have estimated the total volume of waste for Alignment 1 to be approximately 50,000 cubic yards. Because this alignment requires excavation of the least amount of waste, it is expected that it will have the shortest construction duration. A shorter construction duration will reduce the duration in which the community is exposed to odors from the excavation. Landfill odor has been an ongoing concern for the surrounding community and reduced duration for odor emissions would be a favorable advantage.

Bird hazards to air traffic are a significant safety concern to the St. Louis Airport Authority as West Lake Landfill is located within 10,000 feet of the nearest Lambert St. Louis Airport runway (see Section 7). Alignment 1 will result in the least amount of excavated waste and will therefore present less risk of bird hazards and other nuisance species (insects, rodents) that can, in turn, attract more birds, when compared to the other alignments. While this alignment offers the least bird hazard risk, mitigation efforts will still be required to minimize waste exposure during excavation and handling of waste material.

Based on a 2013 bird survey performed during well installation and toe drain excavation activities in the North and South Quarries of the Bridgeton Sanitary Landfill, 256 gulls, geese, doves, and raptors were observed within a 20-day period. According to the Federal Aviation Administration (Dolbeer et al, 2014), these bird species were among the species most frequently struck by airplanes between 1990 and 2013. It is expected that geese and doves would not be attracted to the excavation and waste handling operations to be undertaken as they typically do not consume decomposed waste. However, gulls and raptors are expected to be attracted to the site operations as they will seek out easy food sources including decomposed waste. With gulls, mitigation efforts such as sudden loud noises from bird scaring devices (canons, warning horns) are effective only for a period of a few days as gulls can rapidly adapt to these sounds (Airport Operators Association and General Aviation Awareness Council, 2006). Additionally, since gulls tend to feed at operating landfills as the trucks hauling in trash are “tipped”, it is expected that gulls will likewise feed as excavation is being conducted and trucks are being loaded to move the excavated waste to the staging areas and to load trucks for off-site waste transport. Therefore, minimizing the amount of excavation exposed and reducing the duration of construction will be one of the best bird hazard mitigation strategies for the site.

Storm water management will also require mitigation efforts as birds are attracted to standing water sources. For work previously performed at the Bridgeton Sanitary Landfill, the RPs have ensured that detention basins drain within 24 hours, thereby not providing a continued standing water source to attract birds. It is expected that a similar mitigation method for storm water management would be implemented for each of the IB alignments.

Alignment 1 would be located where there will be no newer waste located on the north side of the IB and will be placed in an area with a maximum waste depth of approximately 40 feet. The extent of waste decomposition and the pressure and insulating conditions in a landfill (often determined by the depth or thickness of the waste) are two of several factors that can contribute to the generation of a future SSE. Older waste and shallower waste located north of the Alignment 1 IB are considered an advantage as these conditions are less likely to support the generation of a future SSE than the newer and deeper waste of Alignments 2 and 3.

Another advantage of Alignment 1 is that the design time would likely be shorter than the design time for Alignment 3 primarily because some of the data required for design of the IB has already been collected. Some geotechnical data would still be required to be collected before design could begin, but these pre-design investigations would likely be shorter in duration than those that would be required for the other alignments, therefore allowing design efforts to be completed in a shorter duration than the other alignments.

Alignment 1 also has an advantage of not having to remove existing North Quarry infrastructure (monitoring wells, landfill gas collection wells, and associated piping) for the installation of Alignment 1. The North Quarry infrastructure was installed as part of the May 2013 First Agreed Order of Preliminary Injunction for the RPs to install infrastructure to monitor for the SSE and control landfill gas. Therefore, the least impact to the existing infrastructure will minimize the design and construction duration as the RPs will not have to remove, redesign, and reinstall the North Quarry infrastructure.

4.5 *Structural IB Alignment 1 Disadvantages Discussion*

While Alignment 1 has comparatively more advantages than Alignments 2 and 3, the disadvantages of Alignment 1 carry some amount of risk that must be considered. While it may be possible to manage the risk associated with these disadvantages, these risks must be considered when selecting an alignment.

The first disadvantage of Alignment 1 is that although the vast majority of RIM will be isolated north of the IB, some RIM will remain on the south side of the IB. Since the purpose of installing the IB is to prevent the SSE in the Bridgeton Sanitary Landfill, from coming into contact with RIM in the West Lake Landfill, leaving some RIM on the south side of the IB would not completely fulfill that purpose. To mitigate this significant disadvantage, the Alignment 1 design would need to include a means for mitigating the RIM remaining on the south side of the IB. Field and laboratory results from the recent sampling performed by the RPs must be evaluated to determine what information is required to evaluate technologies for addressing the remaining RIM, if the risk is shown to be such that remediation is required. Section 5 includes a list of potential options that the RPs could consider to address remaining RIM.

The second disadvantage of Alignment 1 is that the IB would be installed through RIM. Handling RIM during excavating, staging, screening, transporting, and disposal of the RIM are activities that must be appropriately planned during design and carefully managed during construction due to the potential impact to the safety of on-site workers and the potential for RIM release during off-site transportation to disposal facilities.

The on-site worker safety risks can be mitigated through the preparation and thorough execution of Health and Safety Plans; however, preparing and following these procedures does add time to the construction process. Similarly, off-site disposal of RIM will require some over the road transportation. This will result in increased truck traffic in the vicinity of the site and could lead to increased risk for traffic accidents, which could result in spilling RIM along the transportation route.

Excavation through RIM can also lead to off-site exposure risks associated with airborne dust, which could contain RIM. Qualitative assessment of the relative off-site risk due to airborne RIM exposure would be dependent upon the depth of the RIM and the RPs' material handling processes. Mitigation is planned through use of an air monitoring network to monitor for RIM and through proper dust control during excavation activities. Proper planning and response plans to include these mitigation actions will be required to reduce the risk but the preparation and implementation of these mitigation efforts will increase the design and construction durations.

Off-site waste transportation itself is a risk for not only safety reasons, but due to how it can impact the duration of construction. The time it takes to stage, screen, segregate, sample, load, and transport the RIM can add significant time to the construction duration. The exact impacts to the design and construction efforts cannot be quantified at this time and will need to be addressed by the RPs as they determine how the RIM will be managed. The amount of RIM, the saturation of the waste, how the waste will be transported, and the location, permitting, and sampling requirements of the disposal facility will contribute to the schedule risk associated with handling RIM.

There are no known past applications using a concrete wall as a heat barrier in a landfill. There have been studies showing the degradation of strength properties of concrete when exposed to high heat. It may be possible to overcome these issues during design, but more study would be necessary to determine if special mix designs could overcome this issue.

4.6 *Structural IB Alignment 2 Advantages Discussion*

The primary advantage of Alignment 2 is that this alignment should separate all identified RIM from the existing SSE in the Bridgeton Sanitary Landfill. This is a significant advantage as that is the primary reason for the installation of the IB.

Another advantage is that from an off-site safety standpoint, because no RIM is anticipated to be encountered, the risk for on-site and off-site exposure to RIM is low.

4.7 *Structural Alignment 2 Disadvantages Discussion*

The primary disadvantage of Alignment 2 is the significant volume of waste that would need to be excavated. Because the depth of the IB would be approximately 180 feet and the potential for differential settling of the waste on the opposite sides of the IB, the IB design would have to be significantly wider than the IB for Alignment 1 to be capable of withstanding these differential stresses. This effort will significantly increase the design duration as additional time will be required to ensure the design is structurally sound and that the proper cooling system is incorporated. Additional geotechnical data will also need to be collected and getting that data from a deeper depth will take longer. One potential way to mitigate the width of the Alignment 2 IB would be to implement an on-going operation and maintenance plan that restores the surface of the settled waste to prevent the overturning stresses caused by differential settlement of the wastes adjacent to the barrier. The RPs will need to make a determination on which means is most effective for addressing this issue, should this alignment alternative be selected.

Due to the large depth and width of the excavation, the length of time the excavation would remain open would be significantly increased and the odor potential and duration of the odor would, in turn, be significantly increased. The negative impact of the odor and the duration of the odor to the quality of life for the nearby community may not be acceptable.

The significant volume of waste and the length of time to excavate will also significantly increase the bird hazard potential. As discussed in Section 4.4, gulls and raptors are expected to be attracted to the site operations as they will seek out easy food sources. Due to their ability to rapidly adapt to loud and active surroundings, mitigation techniques would have to be aggressive and vary frequently due to the significant duration required to construct this alternative. Additionally, since gulls would be expected to feed as excavation is being conducted and trucks are being loaded to move the excavated waste to the staging areas and to load trucks for off-site waste transport, bird mitigation for this alignment alternative is expected to be challenging over the extended construction duration expected for this alignment alternative.

Alignment 2 would be located within the Bridgeton Sanitary Landfill, therefore, a large amount of the newer waste in this landfill will be located on the north side of the IB. The maximum depth on the north side of the IB would be approximately 180'. The greatest depth of this newer waste would be located between the IB and the Quarry wall, which could potentially increase the pressure and insulating factors, which, if other conditions are right, could contribute to a future SSE on the north side of the IB.

Alignment 2 would be located in the North Quarry of the Bridgeton Sanitary Landfill and should not encounter RIM because there has been no evidence that RIM was placed in this area and because a review of historical records indicated that in 1973, while the RIM was being placed in the West Lake Landfill, the North Quarry was still be excavated. This site conceptual model does not support the presence of RIM from the Latty Avenue site in the North Quarry. Because of this, the risk to the safety of on-site workers due to RIM is determined to be the lowest compared to the other alternatives. However, because of the significant volume and depth to be excavated, the construction techniques, and the length of construction required to install the IB, the general construction safety risk to workers is considered significantly higher than Alignments 1 and 3.

With regards to off-site safety, due to the large volume of waste and limited space on site for staging, off-site disposal will be required. The increased truck traffic in the vicinity of the site will increase the risk for traffic accidents. Additionally, the increased truck traffic waiting to enter and exit the site will impact the existing Transfer Station operations. This could disrupt some of the Transfer Station's operations including customer's trash collection services.

Another disadvantage of Alignment 2 is that monitoring wells, gas collection lines, and gas extraction wells located in the North Quarry would have to be removed prior to installation of the IB and then reinstalled after construction is completed. Due to the long construction duration, that North Quarry infrastructure would not be in place for a long duration. The North Quarry infrastructure was installed as part of an Order for Preliminary Injunction for the RPs to monitor temperature fluctuations, carbon monoxide emissions, and control landfill gas. This infrastructure is important for detecting potential movement of the SSE and controlling landfill gas.

The volume of waste to be excavated with Alignment 2 would result in daily conditions that are considered similar to those of an operating landfill. The number and the significance of the disadvantages of Alignment 2 far outweigh the Alignment 2 advantages. Therefore, all parties were in agreement of not supporting selection of Alignment 2.

4.8 *Structural IB Alignment 3 Advantages Discussion*

The primary advantages of Alignment 3 are that it is technically feasible and requires significantly less volume of waste to be excavated compared to Alignment 2 while minimizing and potentially eliminating RIM remaining south of the IB and potentially exposed to the SSE when compared to Alignment 1.

Another advantage of Alignment 3 is that the on-site safety risk to workers due to RIM exposure will be lower than Alignment 1 and the on-site safety risk to workers due to general construction efforts would be less than Alignment 2 because of the shorter construction duration and less challenging installation.

4.9 *Structural Alignment 3 Disadvantages Discussion*

Although Alignment 3 has significantly less volume of waste to be excavated than Alignment 2, the volume of waste to be excavated for Alignment 3 is considered a disadvantage when compared with the volume of waste to be excavated for Alignment 1. Alignment 3 could have as much as double the volume of waste as Alignment 1. As previously stated, the volume of waste drives the disadvantages with each alignment, so more than doubling the volume of waste will increase the risk associated with those disadvantages.

Alignment 3 will have less potential for odor than Alignment 2, but will have a greater potential for odor than Alignment 1 due to the increased volume of waste to be excavated. In addition to the longer excavation duration, multiple staging areas will also be required for Alignment 3 in order to stage the larger amount of excavated waste so it can be screened prior to disposal. Having multiple staging areas will also contribute to the longer overall construction duration and odor potential. As odor is a quality of life issue for the community, this could be considered a significant disadvantage to the community.

Alignment 3 will also have a significantly less potential for bird hazard compared to Alignment 2 due to the lower volume of excavated waste; however, when compared to Alignment 1, the bird hazard potential increases and therefore, is considered a disadvantage. As discussed in Section 4.4, gulls and raptors are expected to be attracted to the waste and some mitigation efforts are not expected to be effective for more than a few days. Additionally, since gulls tend to feed as the excavated material is loaded onto trucks for transport, netting or other means of mitigation will likely be required to minimize bird hazards.

A disadvantage of Alignment 3 is that it would need to move 50-feet closer to the high quarry wall than the alignment evaluated as Option 3 Alignment in the RPs October 2014 report entitled "Isolation Barrier Alternatives Analysis, West Lake Superfund Site." This will require additional design effort and potentially a thicker wall in the western third of the wall to account for potentially higher differential settlement forces from North Quarry waste settlement. Despite this, the overall level of effort as compared to the Option 3 Alignment in the 2014 report is unlikely to be substantially higher.

With Alignment 3, some of the newer waste in the North Quarry will be located on the north side of the Alignment 3 IB. This overlay area, when combined with the West Lake Landfill Area 1 waste below it, has a maximum depth of waste of approximately 90-feet. The additional depth of waste from the North Quarry overlay and the newer waste located on the north side of the Alignment 3 IB are two factors that can contribute to the generation of a future SSE on the north side of the IB. Because these conditions would exist if this alignment were installed, they are considered a disadvantage. The on-site safety risk for Alignment 3 would be lower when compared to Alignment 1 if little or no RIM is excavated to install this IB. The relative risk for Alignment 3 RIM exposure would be equal or slightly higher compared to Alignment 2 as no RIM is expected to be encountered during excavation of Alignment 2. From a general construction standpoint (not considering RIM), the on-site safety risk for Alignment 3 is higher than Alignment 1 due to the length of the construction duration and higher level of difficultly associated with a deeper wall. The general on-site safety risk for Alignment 3 is considered significantly less than Alignment 2 due to the depth of excavation and the amount of material handling required for Alignment 2.

Alignment 3's off-site risk for exposure to airborne dust containing RIM is considered lower than Alignment 1's risk because Alignment 3 will be placed in an area that is expected to encounter limited RIM, if any, based upon recent sampling results. As indicated in the Alignment 1 discussion, mitigation measures, including air monitoring and dust control, can be employed to control risks during excavation and waste handling.

The duration of design for Alignment 3 will be longer than Alignment 1 due to the need to for a more robust design to address differential settlement. The depth of the waste will increase the amount of time required to collect the data necessary for design. Additionally, because the IB will be deeper in the western portion of the alignment, additional design time will be required due to more complex loadings and structural requirements of the wall. The construction duration for Alignment 3 will also be longer than Alignment 1 due to the increased depth of the western portion of the IB.

Another disadvantage of this IB alignment is the impact to existing infrastructure. The monitoring wells, gas collection lines, and gas extraction wells located in the North Quarry would have to be removed prior to installation of the IB and then reinstalled after construction is completed.

There are no known past applications using a concrete wall as a heat barrier in a landfill. There have been studies showing the degradation of strength properties of concrete when exposed to high heat. It may be possible to overcome these issues during design, but more study would be necessary to determine if special mix designs could overcome this issue.

4.10 *Heat Extraction Barrier Advantages*

The most significant advantage of the heat extraction IB is that the volume of waste to be removed will be negligible compared to any other option. The waste to be removed results from drilling coolant wells. This amount of waste can easily be handled on site.

As a result of the minimized waste, the odors and bird hazards for this alternative is significantly less than the other alternatives. On-site safety risk is also the least of all alternatives due to limited, if any, exposure to RIM or other chemicals. Additionally, offsite exposure to RIM risk would be the least of all the other alternatives as well due to the limited amount of waste handling. Additionally, this alternative would have limited truck traffic when compared to the other alternatives, significantly reducing the off-site traffic accident risk.

One of the other more significant advantages of the heat extraction barrier alternative is that the design time is shorter than the other alternatives and it can be installed within a shorter duration than the structural IB alternatives. Given that there are varying views of the movement of the SSE, shorter design and installation durations are a strong advantage. Because of the shorter design and installation time, the system can be expanded quickly in the event actual monitoring data shows that additional cooling is necessary to contain the heat front.

Data from the RP's pilot study provides a proof of concept for the heat extraction barrier alternative. The proposed heat extraction system combined with the heat sink properties of the surrounding limestone makes the neck area between the North and South Quarries the optimal location to install a cooling system.

4.11 *Heat Extraction Barrier Disadvantages*

The primary disadvantage of the heat extraction barrier is the wells will be subject to high heat, a corrosive environment, and waste settlement. This can be mitigated by planning for well replacement if heat and corrosion or waste settlement impacts the cooling wells. In addition, application of heat extraction wells for this purpose has had limited testing (the RP's pilot study).

Another disadvantage is that the proposed placement of the heat extraction barrier in the neck is that if a future SSE were to occur in the North Quarry, the heat extraction barrier would not be positioned to prevent the SSE from moving into the West Lake Landfill and coming in contact with the RIM. However, the flexibility of the heat extraction barrier alternative is such that additional wells and coolant capacity could be quickly installed at a location between a new SSE and the RIM.

5. Design Considerations

Options to address some of the technical challenges anticipated during design and construction were identified. Following are some of those design considerations.

For Alignment 1 and potentially for Alignment 3, the possibility of encountering RIM during excavation exists. During discussions, the RPs indicated they were considering utilizing a panel wall construction method to install the IB. Utilizing a panel wall construction method would reduce the amount of excavated materials and drilling fluids/slurry that would come into contact with RIM when compared to a continuous trench excavation; however, there could still be a significant volume of waste and fluids resulting from the in panel wall construction that would require handling and disposal as RIM. Because the safe handling and disposing of additional material as RIM will increase the overall duration and cost of the project, alternative construction methods that could further minimize the potential amount of radiologically impacted slurry or drilling fluids should be investigated.

One potential construction method that could be considered to minimize the use of fluids or slurry is the use of a secant pile wall for that portion of the IB that extends through RIM. A secant pile wall would not require use of a slurry, so it would minimize the potential spread of RIM and eliminate handling of RIM contaminated slurry. It is also suitable for installation in difficult subsurface conditions. It also can be used in combination with panel wall installation (panel wall installation on the east portion of the IB and a secant pile wall installation on the west portion of the IB). The primary disadvantage of a secant pile wall installation is that there is less certainty in the continuity of the wall; however, there are installation and down-hole verification techniques to minimize this uncertainty. The RPs would also need to determine how to incorporate an internal cooling system with both the secant pile wall and the panel wall construction methods.

Depending upon the alternative selected, there may be some RIM remaining on the south side of the IB wall that needs to be addressed as part of the IB design. Table 2 summarizes some potential mitigation measures to consider.

Table 2 - Options to Address Remaining RIM

Option	Description	Advantages	Disadvantages
Excavate RIM	Excavate identified RIM remaining on south side of IB	Minimizes risk of RIM contact with SSE	RIM handling, screening, transport, disposal
			Open excavation and increase in odor
			Open excavation and increase in bird hazard to air traffic
			Ensuring IB stability while RIM excavation is conducted adjacent to the IB. This is a significant disadvantage and will increase the size of the IB, the volume of waste to be excavated, and other associated risks. It is possible that excavation after IB installation may not be technically feasible depending upon the location of the remaining RIM with respect to the IB structure.
			Off-site hauling for disposal may increases risk of traffic accidents and RIM release.
In-Situ Stabilization	Utilize deep soil mixing techniques to auger down to RIM, inject cement grout, and mix grout with the waste to immobilize the RIM and adjacent waste into a hardened block less susceptible to the SSE	Reduces the amount of waste to be handled, transported, and disposed	Effects of SSE in contact with stabilized RIM are unknown. Will likely require bench scale testing to verify
		Reduces the amount of exposed waste and therefore reduces the amount of odor	May be difficult to implement in the landfill due to potential loss of grout (in situ deep soil mixing has been successful in normal soil conditions). Some components of waste may hinder hydration of waste so bench scale testing would be required to determine the appropriate stabilization agents.
		Reduces the amount of exposed waste and therefore reduces the bird hazard	Requires thorough identification of RIM to know area requiring stabilization
Liquid N_2 or CO_2 Injection	Inject liquid N_2 or CO_2 into the subsurface as the SSE approaches to cool the subsurface and extinguish the SSE	Effective for smaller areas of RIM	Requires ability to identify location of SSE. Difficult to detect SSE movement
		Waste handling/disposal would be limited to waste generated for injection well installation	Reliable supply of liquid N_2 and CO_2 is not currently available.
		Limited odors- no open excavation	Increased worker safety issues when handling liquid N_2
		Limited bird hazard-no open excavation	
Heat Extraction Barrier	Install closed-system cooling loop and wells to cool the heat front between the RIM and the SSE to prevent the SSE from coming into contact with the RIM.	Flexible and can be implemented quickly. Can be expanded easily if additional cooling is required.	Wells may settle as waste settles and could impact effectiveness of system, causing need for new wells. Well material could be impacted by high heat and corrosion.

Option	Description	Advantages	Disadvantages
Synthetic Landfill Cover & Gas Collection System	Install synthetic cover over top of landfill south of IB where remaining RIM is located. Install gas collection system	Allows for capture of landfill gas.	Landfill gas collected may require treatment prior to discharge.
		Eliminates excavation, reduces need to handle, transport , or dispose of waste	
		Eliminates excavation, minimizes bird hazard.	Any cover could potentially be susceptible to damage from SSE or natural events.
		RPs already planning to install synthetic cover at North Quarry	

If any of these options were to be incorporated, the RPs would need to evaluate each one and, if necessary, conduct the appropriate studies required for design and construction. As part of the design to address any RIM remaining south of the IB, the RPs should evaluate the possible risks to receptors should the SSE come into contact with the remaining RIM.

6. Design Schedule Considerations

It is not known that the SSE will reach the RIM; however, due to the unpredictable nature and movement of the SSE, the length of time for the SSE to reach the RIM in OU1, Area 1 is currently unknown. Therefore, length of time required to design and install the IB was a consideration during this assessment.

The standard industry practice is to complete the design in stages with reviews conducted at each stage. Typical design stages are the 30%, 60%, 90% and 100% design stages. The 30% design stage is conceptual and many of the specific details of the design are not complete and are still being evaluated. The 60% and 90% design stages are more complete with almost all of the details defined. The Final Design represents the completed design product. It is USACE's understanding that a similar design process will be followed for the IB effort and that the documents produced at each stage of the design will be subject to government review and comment.

This staged approach to the design allows for good quality control and helps ensure that all design objectives are met. However, at each stage in the process, a set of documents is produced that requires sufficient time to prepare, review, and then respond to any technical review comments so that those revisions may be carried forward into the next stage. There may be ways to shorten the time required to complete each design stage. Typical methods to speed up the design process are: increase the number of designers; conduct "over the shoulder" or "in progress" reviews while the design team continues working instead of requiring the designers to stop and respond to review comments in between each stage; and reduce the time allowed for the reviewers to perform their review. Each of these methods introduces some chance of error. Rushing the design and quality control reviews in order to start construction earlier may result in problems or delays during construction because those problems were not fully evaluated during the design process.

During a July 2014 meeting between USACE, EPA and the RPs, major pre-design and design tasks were discussed and a general timeline of activities was drafted. Following is the estimated timeline for pre-design and design activities based upon these discussions.

Structural IB Alignment 1 Estimated Pre-Design & Design Schedule:

- 130 calendar days to complete geotechnical investigation, receive and evaluate results
- 60 calendar days to complete 30% Design
- 80 calendar days to complete 60% Design
- 80 calendar days to complete 90% Design
- 40 calendar days to complete Final Design
- 40 calendar days to prepare for start of construction (time to hire subcontractors, obtain applicable construction permits, order supplies & materials, make preparations to begin full-scale construction work)
- Total Design Duration Estimate = 430 days = approximately 14 months from IB alignment decision

Structural IB Alignment 3 Estimated Pre-Design and Design Duration:

- 180 calendar days to complete geotechnical investigation, receive and evaluate results
- 60 calendar days to complete 30% Design
- 110 calendar days to complete 60% Design
- 110 calendar days to complete 90% Design
- 50 calendar days to complete Final Design
- 40 calendar days to prepare for start of construction (time to hire subcontractors, obtain applicable construction permits, order supplies & materials, make preparations to begin full-scale construction work)
- Total Design Duration Estimate = 550 days = approximately 18 months from IB alternative decision

The following schedule is a USACE estimate for comparison purposes only:

Heat Extraction Barrier Estimated Pre-Design and Design Duration:

- 30% Design is complete (conceptual)
- 60 calendar days to complete 60% Design
- 45 calendar days to complete 90% Design
- 45 calendar days to complete Final Design
- 30 calendar days to prepare for start of construction
- Total Design Duration Estimate = 180 days = 6 months from IB alternative decision

Because Alignment 2 was not supported by the RPs, USACE, EPA, or ORD, an estimate for design duration was not considered.

The extent of impact to construction duration for the structural alignments 1 and 3 cannot be accurately assessed at this time as it will depend upon a number of items that the RPs will need to determine during design including the size and number of the staging areas, the RIM screening rate and disposal analysis turn-around time, the number of loaders to load disposal trucks, the number of trucks hauling waste to the off-site disposal site, and the distance to the disposal site. The minimum construction duration is estimated to be 1 year. The estimated construction duration for the heat extraction barrier alternative is estimated to be 60-90 calendar days.

7. Airport Negative Easement Agreement

In 1998, the Federal Aviation Administration (FAA) completed a Record of Decision (ROD) that allowed the Lambert St. Louis International Airport (Airport) to expand its operations. The Airport is owned by the City of St. Louis and operated by the St. Louis Airport Authority. At that time, the Bridgeton Sanitary Landfill was open and actively placing new waste into the landfill. Because the waste material is attractive to birds and other nuisance species (small rodents and other vermin that also attract predator birds), and because of the documented risk that bird populations pose to air traffic safety, the City and the landfill operators entered into a legally binding Negative Easement Agreement (NEA) that forced the landfill operators to stop accepting or placing new waste in the landfill. The NEA went into effect in 2005, and the Bridgeton Sanitary Landfill was closed. This action has been very successful in reducing the wildlife (bird) hazards to aircraft operating at the Airport.

The NEA specifically prohibits placement of any waste above, in, or below the landfill, and requires proper landfill cover at all times in accordance with applicable regulations. Additionally, any variance to these prohibitions requires the City of St. Louis and the St. Louis Airport Authority to issue a waiver to the NEA. Because of the waiver requirement, this NEA carries significant weight in determining the IB alignment and alternative.

Another consideration is the RPs indicated in their Pre-Construction Work Plan that they plan to place excavated non-RIM waste back into the landfill. On-site placement of non-RIM wastes into the closed landfill units as proposed will also require a waiver to the NEA. Additionally, a regulatory determination should be made to determine if relocating waste from one closed landfill unit to another closed landfill unit would constitute operating a landfill or opening a new landfill site.

The impact of not being able to place the non-RIM waste back into the landfill is longer construction duration due to having to haul and dispose of waste at an off-site location. As previously stated, longer construction times increase the risk for not only bird hazards, but safety risks and other risks as well.

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